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PROPOSED

BEST DEMONSTRATED AVAILABLE TECHNOLOGY (BDAT) BACKGROUND DOCUMENT FOR P119 AND P120

U.S. Environmental Protection Agency
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November 1989

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1. INTRODUCTION

Pursuant to Section 3004(m) of the Resource Conservation and Recovery Act (RCRA) as enacted by the Hazardous and Solid Waste Amendments (HSWA) of November 8, 1984, the Environmental Protection Agency (EPA) is proposing treatment standards based on the best demonstrated available technology (BDAT) for vanadium-containing wastes. These wastes are identified in 40 CFR 261.33 under the waste codes P119 and P120. Compliance with these treatment standards is a prerequisite for placement of these wastes in facilities designated as land disposal units according to 40 CFR Part 268. The effective date of final promulgated treatment standards for P119 and P120 will be May 8, 1990.

This background document presents the Agency's technical support and rationale for developing regulatory standards for these wastes. Sections 2 through 6 present waste-specific information for P119 and P120 wastes. Section 2 presents the number and location of facilities affected by the land disposal restrictions, the waste-generating processes, and waste characterization data. Section 3 discusses the technologies used to treat the wastes (or similar wastes), and Section 4 presents available performance data, including data on which treatment standards are based. Section 5 explains EPA's determination of BDAT. Proposed treatment standards for vanadium wastes are determined in Section 6.

The BDAT program and promulgated methodology are more thoroughly described in two additional documents: Methodology for Developing BDAT Treatment Standards (USEPA 1989a) and Generic quality Assurance Project Plan for Land Disposal Restrictions Program ("BDAT") (USEPA 1988a). The petition process to be followed in requesting a variance from the BDAT treatment standards is discussed in the methodology document.

From a partial analysis of responses to EPA's 1986 National Survey of Hazardous Waste Generators, the Agency has information indicating that at least seven facilities presently generate P119 and P120 wastes. These

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facilities generate hazardous wastes that are either nonwastewaters or wastewaters. For the purpose of BDAT, a wastewater is defined by the Agency as a waste containing less than 1 percent (weight basis) total suspended solids* and less than 1 percent (weight basis) total organic carbon (TOC). Wastes not meeting this definition must comply with the standards for nonwastewaters.

The proposed BDAT treatment standard for P119 and P120 nonwastewaters is thermal recovery or stabilization as a method of treatment. BDAT for P119 and P120 wastewaters is chemical precipitation followed by sedimentation and filtration. The proposed BDAT treatment standard for P119 and P120 wastewaters is 0.042 mg/l. The proposed BDAT treatment standards for vanadium are summarized in Table 1-1 and Table 1-2 for nonwastewaters and wastewaters, respectively.

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*The term "total suspended solids" (TSS) clarifies EPA's previously used terminology of "total solids" and "filterable solids." Specifically, the quantity of total suspended solids is measured by Method 209c (Total Suspended Solids Dried at 103° to 105°C) in Standard Methods for the Examination of Water and wastewater, 16th Edition (APHA, AWWA, and WPCF 1985).

Table 1-1 Proposed BDAT Treatment Standards for P119 and P120 Nonwastewaters

THERMAL RECOVERY OR STABILIZATION AS A METHOD OF TREATMENT.

Table 1-2 Proposed BDAT Treatment Standards for P119 and P120 Wastewaters

Regulated constituent	Maximum for any 24-hour composite sample Total composition (mg/l)
Vanadium	0.042

2. INDUSTRIES AFFECTED AND WASTE CHARACTERIZATION

As defined in 40 CFR 261.33, P119 and P120 are the following discarded commercial chemical products, off-specification species, container residues, and spill residues thereof:

P119 - Ammonium vanadate
P120 - Vanadium pentoxide

Section 2.1 describes the industries affected by the land disposal restrictions for P119 and P120 wastes and describes the processes identified by EPA that may generate these wastes. Section 2.2 summarizes the available waste characterization data for these wastes. Section 2.3 uses the Agency's analysis of the sources of P119 and P120 wastes and waste composition to determine waste treatability groups.

2.1 Industries Affected and Process Descriptions

The industries affected by the land disposal restrictions for P119 and P120 are: (1) the inorganic chemicals industry, which produces or recovers vanadium pentoxide and ammonium vanadate, and (2) several industries that use vanadium compounds to manufacture metal alloys and to manufacture catalysts used in the production of sulfuric acid, adipic acid, and phthalic anhydride and in vapor-phase organic polymerizations.

2.1.1 Production of Inorganic Vanadium Compounds

According to the U.S. Bureau of Mines, approximately 5,000 tons of vanadium was consumed in 1988. Approximately 90 percent of the vanadium was used in production of ferrous vanadium alloys and the remaining 10 percent was used in the production of ammonium metavandate, vanadium pentoxide, and other compounds. Therefore, less than 500 tons of

vanadium were used in the production of ammonium metavanadate and vanadium pentoxide. (U.S. Bureau of Mines, 1989). These two chemicals are produced from three sources: (1) vanadium recovery from ore processing; (2) recovery from spent catalysts; and (3) recovery from boiler ash, especially from utilities burning Venezuelan and other Caribbean residual oils. The current manufacturers of vanadium compounds and facilities that recover vanadium from spent materials are shown in Table 2-1. Most vanadium produced in the United States is produced as either vanadium pentoxide or ammonium metavanadate from mined ores or recovery processes. Uranium production and some phosohorus production facilities produce vanadium as a beneficial byproduct. Vanadium recovery from spent catalysts or from Stretford solutions (discussed in Sections 2.1.1 and 2.1.2, respectively) also contributes to the production of vanadium compounds.

(1) Recovery from Ore Processing. Vanadium is recovered domestically as a principal mine product, as a coproduct or by-product from uranium-vanadium ores, and from ferrophosphorus ores as a by-product in the production of elemental phosphorus.

The first stage in ore processing is the production of an oxide concentrate. The principal vanadium-bearing ores are generally crushed, ground, screened, and mixed with a sodium salt, e.g., NaCl or Na_2CO_3. This mixture is roasted at about 850°C and the vanadium oxides are converted to water-soluble sodium metavanadate, $NaVO_3$. The vanadium is extracted by leaching with water. It is then precipitated at pH 2-3 as sodium hexavanadate, $Na_4V_6O_{17}$, a red cake, by the addition of sulfuric acid. This is then fused at 700°C to yield a dense black product which is sold as technical-grade vanadium pentoxide (V_2O_5). This product contains a minimum of 86 percent V_2O_5 by weight and a maximum of 6 to 10 percent Na_2O by weight.

Table 2-1 Manufacturers and Recoverers of Vanadium Compounds

Manufacturers	Location
Kerr-McGee Corporation	Soda Springs, Idaho
Union Carbide Corporation, UMETCA Minerals Corporation (subsidiary)	Blanding, Utah
Shieldalloy Corporation	Cambridge, Ohio
Strategic Minerals Corporation	Hot Springs, Arkansas
Recovery Facilities	**Location**
Gulf Chemical and Metallurgical	Freeport, Texas
UPE - SOMEX, Ltd.	Bartlesville, Oklahoma
AMAX metals Recovery	Braithwaite, Louisiana
Dow Chemical	Freeport, Texas
IT Corporation	Benicia, California

References: USEPA 1986b, Environmental Progress 1986.

The red cake can be further purified by dissolution sodium oxide in an aqueous solution of Na_2CO_3. Iron, aluminum, and silicon impurities precipitate from the solution upon pH adjustment. Ammonium metavanadate (NH_4VO_3) then precipitates upon the addition of NH_4Cl. This compound is then calcined to give vanadium pentoxide of greater than 99.8 percent purity.

Vanadium and uranium are extracted from carnotite (a uranium ore containing vanadium) by direct leaching of the raw ore with sulfuric acid. An alternative method is roasting the ore followed by successive leaching with H_2O and dilute HCl or H_2SO_4. In some cases, the first leach is with a Na_2CO_3 solution. The uranium and vanadium are then separated from the pregnant liquor by liquid-liquid extraction techniques involving careful control of the oxidation states and pH during extraction and stripping. The product is usually in the form of ammonium metavanadate.

(2) Recovery from Spent Catalyst. Vanadium recovery from spent catalysts is typically accomplished through a process that involves thermal oxidation, leaching, metals precipitation with caustic, and final oxidation and granulation. Spent catalysts typically contain about 5 percent vanadium compounds. Any waste containing comparable or higher levels of vanadium should be manageable by this technology.

Processes that recover vanadium from spent catalysts separate the spent catalyst into four products: molybdenum trisulfide, vanadium pentoxide, alumina trihydrate and nickel-cobalt concentrate. A typical example of this process is described in greater detail in Section 3.1.1(1).

(3) Recovery from Boiler Ash. Vanadium is removed as a process waste in hydrotreating of crude petroleum and deposited upon an alumina catalyst which contains either nickel and molybdenum or cobalt and molybdenum. The vanadium adsorbed on the catalyst may exist in one of several oxidation states, not necessarily the pentavalent form. The catalyst is normally sent to a facility for recovery of the vanadium, molybdenum, nickel, cobalt, and alumina (see description of recovery process in Section 3.1.1(1)).

2.1.2 Users of Inorganic Vanadium Compounds

Presently, the bulk of vanadium and its compounds are utilized in alloying iron and steel to enhance physical properties and in catalyst operations. In addition, a growing utilization is also for "sweetening" of Claus unit effluent tail gases through the Stretford Process. (Claus units recover sulfur from gases containing hydrogen sulfide.)

The most important use of vanadium is as an alloying element in the steel industry where it is added to produce grain refinement and hardenability in steels. Vanadium is a strong carbide former, which causes carbide particles to form in the steel, thus restricting the movement of grain bounderies during heat treatment. This produces a fine-grained steel and which is more resistant to cracking during cooling. In addition, the carbide dispersion confers wear resistance, weldability, and good high temperature strength. Vanadium steels are used in dies or taps because of their deep-hardening characteristics and for cutting tools because of their wear resistance. They are also used as constructional steel in light and heavy sections; for heavy iron and steel castings; for forged parts, e.g., shafts and turbine motors; for automobile parts, e.g., gears and axles; and for springs and ball bearings. Vanadium is an important component of ferrous alloys used in jet-aircraft engines and turbine blades where high temperature creep resistance is a basic requirement.

When vanadium is used for alloying, little or no waste is anticipated. Airborne contamination would be trapped in cyclonic or electrostatic precipitators and the dust would be reintroduced into the alloy manufacturing process. Recovered dust might also be sent for reclamation if not directly reintroduced into the process.

The use of vanadium compounds as catalysts is expected to generate the greatest vanadium waste volumes. Catalysts become "poisoned" with use and must be replaced on some periodic basis. Vanadium compounds are used as catalysts in the production of sulfuric acid, adipic acid, phthalic anhydride, and in vapor-phase organic polymerizations. The major producers of adipic acid and phthalic anhydride are presented in Table 2-2. The Agency expects that most of these operations would be able to ship the spent catalysts to reclaiming operations for recovery.

Ammonium metavanadate wastes would result from "poisoned" catalysts or from off-spec production of the final product. Ammonium metavanadate resulting form "poisoned" catalyst is not considered P119 when disposed of, but would be treated in the same manner as nonwastewater P119 at a vanadium recovery facility. The producers of ammonium vanadate are capable of reintroducing off-spec material into a calcining operation and eliminating any potential waste. "Poisoned" catalysts would normally be forwarded to a recovery unit for reclamation of the vanadium and other materials of value.

The Stretford process was developed for removing sulfur compounds from Claus process tail gases. The process is effective for the removal of up to 5 volume percent hydrogen sulfide to less than 10 ppm. Fresh Stretford solution typically contains sodium vanadate, the disodium salt of anthraquinone disulfonic acid (ADA), and a sodium carbonate/bicarbonate buffer.

Table 2-2 Manufacturers of Adipic Acid and Phthalic Anhydride

Major Adipic Acid Producers	Location
DuPont	Orange, Texas
DuPont	Victoria, Texas
Monsanto	Pensacola, Florida
Allied Signal	Hopewell, Virginia
Major Phthalic Anhydride Producers	**Location**
BASF	Kearney, New Jersey
Exxon	Baton Rouge, LA
Koppers Company	Cicero, Illinois
Stephan Company	Millsdale, Illinois
Tenn-USS Chemical	Pasadena, California

Reference: SRI 1989.

of anthraquinone disulfonic acid (ADA), and a sodium carbonate/bicarbonate buffer.

During normal operation of the process, sodium thiosulfate and sodium sulfate are formed as oxidation byproducts of sodium bisulfite in the regeneration step.

The presence of sulfate and thiosulfates have deleterious effects on solution chemistry and corrosivity. Because of this, Stretford solution is typically purged from a commercial unit when the sodium thiosulfate pentahydrate concentration is greater than 250 g/l or the sodium sulfate concentration is greater than 80 g/l. Concentrations of sulfate and thiosulfate normally reach these levels in nine to twelve months of processing. Therefore, under normal operating conditions, the entire solution inventory must be disposed of at least once per year. The solution inventory of a typical Stretford process unit is approximately 100,000 gallons.

Spent Stretford solutions are not classified as hazardous wastes under RCRA but contain substantial quantities of sodium vanadate and sodium vanadite. The solutions normally require treatment prior to discharge to publicly-owned treatment works (POTW) or to receiving waters (regulated under NPDES permit requirements), and the State of California has regulated the disposal of the spent solutions. Some of the material is presently sent to land disposal or is deep well injected. The higher the vanadium content of the spent solution, the more economical the recycling becomes. The recycling scheme for the spent Stretford solutions is the same as that employed for recycling vanadium waste from spent catalysts.

Reporting generators of P120 wastes showed very small amounts of waste produced. The EPA's treatment, storage, disposal, and recycling

(TSDR) survey indicates that two facilities land disposed of significant quantities of P120 in 1986. Anticipated generators of vanadium pentoxide wastes would be boiler operators burning Venezuelan or other Caribbean residual oils and oil refineries that perform hydrotreating to remove vanadium and other metallic impurities.

2.2 Waste Characterization

From a partial response to EPA's 1986 National Survey of Hazardous Waste Generators (USEPA 1986a), the Agency has information on an ore processing facility generating P119 waste and on six facilities generating P120 waste. Data for these facilities are from mixtures of wates containing wastes other than P119 or P120. However, these are the only data available.

The vanadium in the waste mixture containing P119 shows a concentration range of 1 to 10 ppm. The vanadium in the waste mixtures containing P120 shows a concentration range of 1 to 25 percent. For two generators, data were available for only P120. These data indicate vanadium present at 50 to 75 percent for one facility and at greater than 90 percent for the other facility.

2.3 Determination of Waste Treatability Groups

In the case of vanadium compounds, the pentoxide form (P120) is produced through thermal oxidation of ammonium vanadate (P119) (produced during uranium production via liquid/liquid extraction) or from the treatment (involving thermal oxidation) of spent catalysts. Thus, regardless of the whether the vanadium is in the form of P119 or P120 waste, thermal oxidation of the nonwastewater compounds is likely to result in a material (vanadium pentoxide) that has been demonstrated to be recoverable through leaching, precipitation, and calcining.

Based upon a review of information on the production and use of the two vanadium compounds, on the generation of P119 and P120 wastes, and on the available waste characterization data, the Agency has determined that P119 and P120 nonwastewaters comprise one treatability group, and that the wastewaters also comprise a single treatability group.

3. APPLICABLE AND DEMONSTRATED TREATMENT TECHNOLOGIES

Section 2 established one treatability group for P119 and P120 nonwastewaters and wastewaters. This section identifies the treatment technologies that are applicable and determines which, if any, of the applicable technologies can be considered demonstrated for the purpose of establishing BDAT.

To be applicable, a technology must be theoretically usable to treat the waste in question or to treat a waste that is similar in terms of the parameters that affect treatment selection. For detailed descriptions of the technologies applicable for these wastes, or for wastes judged to be similar, see EPA's Treatment Technology Background Document (USEPA 1989b). To be demonstrated, the technology must be employed in full-scale operation for the treatment of the waste in question or a similar waste. Technologies available only at pilot- and bench-scale operations are not considered in identifying demonstrated technologies.

3.1 Applicable Treatment Technologies

3.1.1 Applicable Technologies for Nonwastewaters

EPA has identified thermal recovery and stabilization as applicable treatment technologies for nonwastewater forms of P119 and P120 wastes. These technologies are discussed below.

(1) Thermal recovery. Vanadium recovery is typically accomplished through a process that involves thermal oxidation, leaching, metals precipitation with caustic, and final oxidation and granulation. Spent catalysts typically contain about 7 percent vanadium compounds. Any waste containing comparable or higher levels of vanadium should be manageable by this technology.

The following is a description of the CRI-MET process currently employed at the AMAX Metals Recovery facility in Braithwaite, Louisiana, and is considered typical for the industry: The CRI-MET process uses a two stage leach process, one for the solubilization of vanadium and molybdenum and the other for the solubilization of alumina. It separates the spent catalyst into four products: molybdenum trisulfide, vanadium pentoxide, alumina trihydrate and nickel-cobalt concentrate.

Upon receipt of the spent catalyst, it is fed to a ball mill, along with caustic soda (NaOH). There it is finely ground and partially leached. The slurry is then pumped to the first stage leach autoclave where it is oxidized at high temperature and pressure. Sulfur is converted to sulfate, hydrocarbons are mostly destroyed and the molybdenum and vanadium are dissolved. The solution is then filtered and fed to the vanadium recovery process. The solids, along with recycle caustic, make up the feed for the second stage alumina leach autoclave which operates exactly as the first stage.

Vanadium recovery from the first stage leach solution follows molybdenum precipitation. The vanadium is precipitated with caustic. It is washed, centrifuged, dried, oxidized and granulated. Recovery processes usually recover the vanadium in its pentoxide state. End use may dictate further refinement of the initially produced or recovered vanadium compound.

The process does not generate a solid waste (all nonwastewater residuals from this process are recyclable). The wastewaters are typically processed through a wastewater treatment system before discharge under NPDES Permit.

(2) <u>Stabilization technologies</u>. Stabilization is identified as an applicable technology for treatment of nonwastewaters containing BDAT-

list metals. Stabilization technologies involve mixing the waste with lime/fly ash mixtures, cement, concrete mixtures, or other formulations, both proprietary and nonproprietary. Water is then added, and the mxiture sets into a solid mass in which the leachability of the metals is reduced compared to that in the untreated waste. Stabilization technologies are discussed in detail in the Treatment Technology Background Document (USEPA 1989b).

3.1.2 Applicable Technologies for Wastewaters

EPA has identified chemical precipitation as a technology applicable to wastewater forms of P119 and P120 wastes. A common precipitating agent used for removal of vanadium from wastewaters is ferric sulfate, which is added with pH adjustment. By treating with ferric sulfate, the vanadium is removed from the wastewaters as ferric metavanadate, which is relatively insoluble and remains in the filter cake.

3.2 Demonstrated Treatment Technologies

3.2.1 Demonstrated Technologies for Nonwastewaters

EPA believes thermal recovery is a demonstrated treatment technology for P119 and P120 because information is available indicating that nonwastewaters containing greater than five percent of vanadium can be recovered using this process.

EPA believes that P119 and P120 nonwastewaters can be stabilized since these two wastes are inorganic compounds. Stabilization has been used on a commercial basis to treat many wastes containing BDAT list metals in an inorganic waste matrix.

3.2.2 Demonstrated Technologies for Wastewaters

Chemical precipitation is a demonstrated technology because it is used on a commercial basis to remove metal constituents from process wastewaters. Although data are not available specifically for chemical precipitation of P119 and P120, data are available from the Agency's Office of Water for chemical precipitation of wastewaters containing metal constituents, including vanadium.

4. PERFORMANCE DATA BASE

This section presents relevant data available to EPA on the performance of demonstrated technologies in treating listed wastes containing vanadium compounds in concentrations similar to concentrations expected to be found in P119 and P120 wastes. These data are used elsewhere in this document for determining which technologies represent BDAT (Section 5) and for developing treatment standards (Section 6). Eligible data, in addition to full-scale demonstration data, may include data developed at research facilities or obtained through other applications at less than full-scale operation, as long as the technology is demonstrated in full-scale operation for a similar waste or wastes as defined in Section 3.

Performance data, to the extent that they are available to EPA, include the untreated and treated waste concentrations for a given constituent, the values of operating parameters that were measured at the time the waste was being treated, the values of relevant design parameters for the treatment technology, and data on waste characteristics that affect performance of the treatment technology.

Where data are not available on the treatment of the specific wastes of concern, the Agency may elect to transfer data on the treatment of a similar waste or wastes, using a demonstrated technology. To transfer data from another waste category, EPA must find that the wastes covered by this background document are no more difficult to treat (based on the waste characteristics that affect performance of the demonstrated treatment technology) then the treated wastes from which performance data are being transferred.

4.1 Performance Data for Nonwastewaters

The Agency does not have performance data on the recovery technologies for the treatment of P119 and P120.

EPA does have performance data for treatment of vanadium-containing nonwastewaters using stabilization as shown in Table 4-1. The data presented are performance data developed from stabilization of K048 amd K051 waste. These data were not used to calculate a performance standard since the concentration in the untreated waste was in the 690 to 910 ppm range. These concentration values may be well below the expected vanadium concentration levels for P119 and P120, therefore, the level of treatment achieved for these levels of vanadium may not be achieved for P119 and P120 wastes containing higher amounts of vanadium.

4.2 Performance Data for Wastewaters

Wastewater treatment data from EPA's Office of Water have been analyzed for the development of concentration-based treatment standards for P119 and P120 and other wastewaters. Further information on these data, including the sources of the data and the treatment technologies used, can be found in the Preamble to the Proposed Rule and in the Best Demonstrated Available Technology (BDAT) Background Document for Wastewaters Containing BDAT List Constituents (USEPA 1989c).

Table 4-1 Treatment Performance Data Collected by EPA for K048 and K051
Plant 1 - Stabilization of Incinerator Ash

	Untreated waste		Treated waste: TCLP extracts of stabilized fluidized bed incinerator ash								
			Cement binder			Kiln dust binder			Lime and fly ash binder		
	Total composition (mg/kg)	TCLP (mg/l)	Run 1 mg/l (ppm)	Run 2 mg/l (ppm)	Run 3 mg/l (ppm)	Run 1 mg/l (ppm)	Run 2 mg/l (ppm)	Run 3 mg/l (ppm)	Run 1 mg/l (ppm)	Run 2 mg/l (ppm)	Run 3 mg/l (ppm)
167. Vanadium	695-910	2.5-3.6	1.4	1.21	1.29	1.53	1.64	1.56	0.148	0.149	0.156
Design and operating parameters											
Binder to waste ratio			0.2	0.2	0.2	0.2	0.2	0.2	NA	NA	NA
Lime to waste ratio			NA	NA	NA	NA	NA	NA	0.2	0.2	0.2
Fly ash to waste ratio			NA	NA	NA	NA	NA	NA	0.2	0.2	0.2
Water to waste ratio			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Ambient temprature (°C)			23	23	23	19.0	19.5	20	19	19	19
Mixture pH			11.6	11.5	11.5	12.1	12.1	12.1	12.0	12.1	12.1
Cure time (days)			28	28	28	28	28	28	28	28	28
Unconfined compression strength (lb/in^2)			943.5	921.6	1270	222.8	267.7	241.0	565.8	512.6	578.8

NA = Not applicable.

Source: USEPA 1988.

5. IDENTIFICATION OF BEST DEMONSTRATED AVAILABLE TECHNOLOGY (BDAT)

This section presents the Agency's rationale for determining best demonstrated available technology (BDAT) for P119 and P120 nonwastewaters and wastewaters.

To determine BDAT, the Agency examines all available performance data on technologies that are identified as demonstrated to determine (using statistical techniques) whether one or more of the technologies perform significantly better than the others. The technology that performs best on a particular waste or waste treatability group is then evaluated to determine whether it is "available." To be available the technology must (1) be commercially available to any generator and (2) provide "substantial" treatment of the waste, as determined through evaluation of accuracy-adjusted data. In determining whether treatment is substantial, EPA may consider data on the performance of a waste similar to the waste in question provided that the similar waste is at least as difficult to treat. If the best technology is found to be not available, then the next best technology is evaluated, and so on.

The most desirable waste management technology is one that results in no residual streams or a residual stream with no hazardous properties. EPA has identified demonstrated thermal recovery technologies for vanadium spent catalyst wastes containing vanadium pentoxide and ammonium metavandate. However, the Agency realizes that this option is available only to generators of wastes with recoverable quantities of vanadium. For those high vanadium wastes, thermal recovery is the best treatment. For wastes containing lower vanadium concentrations, stabilization is the best technology. Since the Agency does not have sufficient data to determine the level at which both stabilization and thermal recovery is feasible (and thus to establish two separate treatability groups), it believes that both stabilization and thermal recovery are best.

EPA has identified chemical precipitation as a demonstrated technology for wastewaters containing BDAT list metals. Chemical precipitation is the only technology for which the Agency has treatment data for vandaium containing wastewaters. Therefore, it is the best technology for treatment of wastewater forms of P119 and P120. The Agency recognizes that chemical precipitation is a well-established method for removal of metals from wastewaters, thus, this technology is available.

6. DEVELOPMENT OF BDAT TREATMENT STANDARDS

In Section 5, the best demonstrated available technology was identified for nonwastewaters and wastewaters. In this section, BDAT treatment standards are developed for these technologies based on the performance data presented in Section 4.

6.1 BDAT Treatment Standards for Nonwasterwaters

Because the Agency does not have data on the performance of thermal recovery technologies for the treatment of P119 and P120 nonwastewaters, it is unable to establish a concentration-based standard. The Agency is, however, proposing thermal recovery as a method of treatment. However, the Agency does not think that at very low concentrations and low waste volumes, thermal recovery is a viable treatment alternative for vanadium wastes. Because the Agency believes that P119 and P120 nonwastewaters can also be stabilized, the Agency is also proposing stabilization as an alternative BDAT treatment method for nonwastewaters.

Thus, the Agency is proposing a treatment standard of thermal recovery or stabilization as a method of tratment for P119 and P120.

6.2 BDAT Treatment Standarrds for Wastewaters

The proposed treatment standard for vanadium was calculated from wastewater treatment data from the Agency's Office of Water. Based on these treatment data, the Agency is proposing a treatment standard of 0.042 mg/l vanadium for P119 and P120 wastewaters. The details of this calculation, including accuracy adjustment of treatment data and calculation of variability factor, are shown in the Best Demonstrated Available Technology (BDAT) Background Document for Wastewaters Containing BDAT List Constituents (USEPA 1989c).

Table 6-1 Proposed BDAT Treatment Standards for P119 and P120 - Nonwastewaters

THERMAL RECOVERY OR STABILIZATION AS A METHOD OF TREATMENT

Table 6-2 Proposed BDAT Treatment Standards for P119 and P120 - Wastewaters

Regulated constituent	Maximum for any 24-hour composite sample Total composition (mg/l)
Vanadium	0.042

7. REFERENCES

SRI. 1989. SRI International. 1989 directory of chemical producers, United States of America. Menlo Park, California: SRI International.

USEPA. 1986. U.S. Environmental Protection Agency, Office of Solid Waste. National survey of hazardous waste generators. Washington,, D.C.: U.S. Environmental Protection Agency.

USEPA. 1988a. U.S. Environmental Protection Agency, Office of Solid Waste. Generic quality assurance project plan for Land Disposal Restrictions Program ("BDAT"). Washington, D.C.: U.S. Environmental Protection Agency.

USEPA. 1988b. U.S. Environmental Protection Agency, Office of Solid Waste. Onsite engineering report for Waterways Experiment Station for K048/K052. Draft report. Washington, D.C.: U.S. Environmental Protection Agency.

USEPA. 1989a. U.S. Environmental Protection Agency, Office of Solid Waste. Methodology for developing BDAT treatment standards. Washington, D.C.: U.S. Environmental Protection Agency.

USEPA. 1989b. U.S. Environmental Protection Agency, Office of Solid Waste. Treatment technology background document. Washington, D.C.: U.S. Environmental Protection Agency.

USEPA. 1989c. U.S. Environmental Protection Agency, Office of Solid Waste. Best demonstrated available technology (BDAT) background document for wastewaters containing BDAT list constituents. Washington, D.C.: U.S. Environmental Protection Agency.